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INTERNATIONAL DOLPHIN CONSERVATION ACT ANNUAL REPORT TO CONGRESS - 1995

By

Elizabeth F. Edwards

ADMINISTRATIVE REPORT LJ-96-08

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INTERNATIONAL DOLPHIN CONSERVATION ACT
Annual Report to Congress - 1995[1]

Prepared by

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La Jolla, California 92038-0271

JULY 1996

ADMINISTRATIVE REPORT LJ-96-08

[1] Submitted by Rolland A. Schmitten, Assistant Administrator for Fisheries, National Marine Fisheries Service/NOAA, to The Honorable Ted Stevens, Chairman, Subcommittee on Oceans and Fisheries, Committee on Commerce, Science, and Transportation, United States Senate, Washington, DC.

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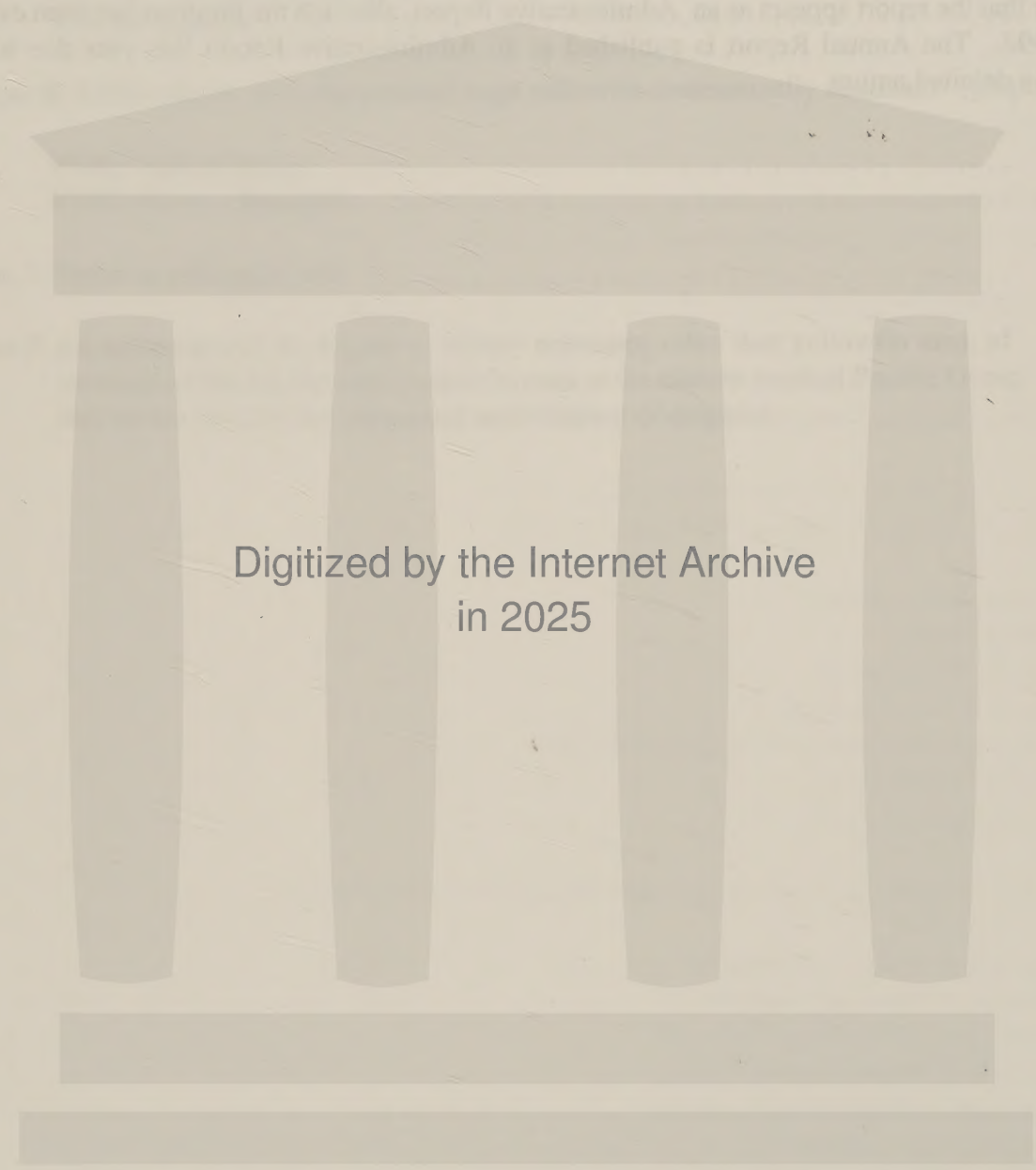
PREFACE

This Administrative Report preserves the International Dolphin Conservation Act (IDCA) Annual Report to Congress for 1995 in a format accessible to literature search. The IDCA Report is required annually to document progress made in the Dolphin-Safe Research Program. This is the first year that the report appears as an Administrative Report, although the Program has been extant since 1992. The Annual Report is published as an Administrative Report this year due to its unusually detailed nature.



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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
1335 East-West Highway
Silver Spring, MD 20910
THE DIRECTOR

FEB 22 1996

The Honorable Ted Stevens
Chairman, Subcommittee on
Oceans and Fisheries
Committee on Commerce,
Science, and Transportation
United States Senate
Washington, D.C. 20510

Department of Commerce
National Marine Fisheries Service
MAR 01 1996
Southwest Fisheries Science Center
La Jolla, California

The Honorable Don Young
Chairman, Committee on Resources
House of Representatives
Washington D.C. 20515

Dear Sirs:

I am pleased to submit to you the National Marine Fisheries Service (NMFS) 1995 Annual Report on dolphin safe research as required by section 304 (Reviews, Reports, and Recommendations) of the International Dolphin Conservation Act of 1992 (IDCA). The report addresses other activities conducted pursuant to the IDCA from January 1, 1995, through December 31, 1995. Future reports required under the IDCA (Title III of the Marine Mammal Protection Act (MMPA)) will be included in the MMPA annual report.

Sincerely,

Rolland A. Schmitten

Enclosure

cc: F/PR(R); F/PR2-Cain; F/CU(2); SWC-Tillman, Edwards;
SWR-Wilkes; F/IA; GCF; GCSW; F/PC-N. Williams, LAF
F/PR2:CAIN:301-713-2055:02/08/96:PH:c:\peaches\idca95

THE ASSISTANT ADMINISTRATOR
FOR FISHERIES

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INTERNATIONAL DOLPHIN CONSERVATION ACT
Annual Report to Congress - 1995

INTRODUCTION

Section 304 (Reviews, Reports, and Recommendations) of the International Dolphin Conservation Act of 1992 (IDCA) states (as shown in the Congressional Record for September 22, 1992 (pg. H9064-H9067) that the Secretary shall submit annual reports to the Congress which shall include

1) reports of research pursuant to Section 303 (Research Programs);
2) a description of the status of stocks of yellowfin tuna;
3) an assessment of the economic impacts on the tuna industry and consumers caused by the moratorium established by agreements entered into under Section 302 (International Agreements to establish a global moratorium to prohibit certain tuna harvesting practices);
4) an assessment of the effectiveness of the moratorium in protecting dolphin populations in the eastern tropical Pacific Ocean;
5) results of reviews conducted under Section; 305(c)(International Commitments: Reviews and Reports)
6) copies of any international agreements or undertakings related to this title;
7) an assessment of the impact on fishery resources, other than yellowfin tuna, of methods of fishing for large yellowfin tuna in the eastern tropical Pacific Ocean that do not involve the intentional encirclement of dolphins;
8) any other relevant information.

Responses to items 1, 3, 4, 5, 6 and 8 are not required for this year's report because these items relate to actions that would occur only after an international agreement had been entered into between the U.S. and any "major fishing nations". No such agreement has been reached. Although strictly speaking, Items 1 and 6 refer only to agreements reached under the IDCA, we include here under Item 1 summaries of relevant research conducted by the National Marine Fisheries Service (NMFS) as well as status reports for related cooperative research projects undertaken by the NMFS and the Inter-American Tropical Tuna Commission (IATTC) since the inception in 1992 of the Dolphin-Safe Research Program at NMFS Southwest Fisheries Science Center. Items 2 and 7 can be addressed regardless of whether the U. S. has entered into any agreements with major fishing nations; responses for these items refer to the period January 1 - December 31, 1995. Responses to Items 1, 2, and 7 appear below.

Item 1: Reports of research pursuant to Section 303 (Research Progress), and

Item 6: International agreements or undertakings related to this title.

Included here is a summary of all Dolphin-Safe Research Program work completed since the program's inception in 1992 plus a description of future research plans based on results to date.

The Dolphin-Safe Research Program was initiated in October 1992 to investigate the potential for capturing large yellowfin tuna in the eastern tropical Pacific Ocean (ETP) without

encircling dolphins. The Program has focused on obtaining definitive answers to a series of three questions. If the answer to any question in the series is "no" then future efforts should be redirected. Two years were allotted to addressing and answering each question, comprising a projected 6-year research effort leading to a definitive answer at the completion of the final two-year cycle.

The three questions focusing Program progress are:

1) are large yellowfin tuna ever disassociated from dolphins in the ETP? (FY92-FY93)
2) can unassociated large yellowfin tuna be routinely detected in the ETP? (FY94-FY95)
3) are unassociated, detectable large yellowfin available in commercially adequate abundance? (FY96-FY97)

The first phase of the research cycle was completed during FY92 and FY93. The second cycle was completed at the end of FY95. The third cycle will depend upon funding - if continued at previous levels, the third phase of the cycle should be completed in FY97.

The answer to the first question was "yes". Preliminary review of recently completed contract results indicates that the answer to the second question is also "yes". Given continued availability of funds, the third question will be addressed by conducting research survey(s) of the abundance and distribution of unassociated large yellowfin in the ETP using the detection methods recommended as the result of answering Question #2 and in conjunction with the yellowfin tuna experts from the IATTC.

Activities and accomplishments within each phase are summarized below.

PHASE I RESEARCH (FY92-FY93): Are large yellowfin unassociated?

Research Planning Workshop I: Southwest Fisheries Science Center, March 5-6, 1992. The workshop team included scientists from NMFS, IATTC, Marine Mammal Commission, and academia. The team reviewed and prioritized research proposals. Major recommendations were to fund proposals for tuna-dolphin tracking, apex predator food habits, tuna oceanography, and LIDAR detection technology. These recommendations provided the basis for research during Phase I. Goals and objectives for the Dolphin-Safe Research Program were subsequently published in:

DeMaster, D. 1992. Strategic Plan to Develop and Evaluate "Dolphin-Safe" Methods of Fishing for Yellowfin Tuna in the Eastern Tropical Pacific Ocean. Southwest Fisheries Center Administrative Report LJ-92-16. 21 p.

Federal Register. 1992. Notice of availability of Research Plan and request for comments./Vol. 57, No. 96/Monday, May 18, 1992/Notices, p. 21081.

Tuna-Dolphin Tracking Cruises I and II: These tracking cruises were designed to determine the degree of association between tunas and dolphins. Research protocol involved capturing associated tunas and dolphins using standard tuna purse-seining methods, radio-tagging at least one dolphin and sonic-tagging at least one yellowfin tuna from the captured association, and subsequently following each of the tagged animals as long as possible after release.

Cruise I (November-December 1992): Cooperative venture between NMFS, IATTC, and Mexico's Tuna-Dolphin Program (Programa Nacional para el Aprovechamiento del Atun y Proteccion de los Delfines, PNAAPD), using a U.S. commercial tuna purse-seiner (*Nicole K*), contracted for 30 days of ship time (November 6-December 5, 1992). Tunas and dolphins were captured by the *Nicole K* and tracked from the NOAA research ship *R/V McArthur*. Tuna and dolphin tagging procedures were developed during the cruise. Dolphins were tagged during five sets, tunas during two sets. During the study, six dolphins were tracked; five dolphins were tracked for 1-2 days; a sixth track was abandoned after 2.5 hours to make another set. In addition, two of three time-depth recorders (TDRs) were recovered during repeat sets on previously captured animals which had been at liberty 25-45 hours.

Armstrong, W. A. 1993. Field notes recorded by NMFS field party leader during dolphin-safe charter aboard the fishing vessel *Nicole K*, November 4 - December 7, 1992. Southwest Fisheries Science Center Administrative Report LJ-93-15.

P.O. 40ABNF202036. Contract with IATTC to conduct tracking study of dolphins and tuna. Awarded to Drs. Michael Scott and Robert Olson, IATTC. $133,000.

P.O. 50ABNA300010. Charter Contract to Kozplaz, Inc., owners of commercial purse-seiner *Nicole K*. Commercial seiner provided means of capturing associated tunas and dolphins and provided backup tracking support. $593,782.

Cruise II (November-December 1993): Repeat of Cruise I with Mexican tuna purse-seiner providing capture capacity. Dolphin tagging, tracking, and time-depth recorder recovery were equally successful as during Cruise I. In addition, 2 yellowfin tuna were successfully tagged, released, and tracked, one for 30 hours. Tracks show that the tuna-dolphin association can be very loose, even when tunas and dolphins are relatively close (within kilometers). Tracks also show distinct differences in tuna behavior and in dolphin behavior day vs. night. In particular, dolphins tended to dive deeper at night, while tuna moved closer to the surface.

Armstrong, W.A. 1993. Revised and edited field notes, 1993. Dolphin-tuna tracking study, November 6-December 6, 1993. Southwest Fisheries Administrative Report LJ-94-06.

Combined results from both cruises, indicating clearly that the tuna-dolphin association is much looser than previously thought, are reported in:

Olson, R. and K. Holland. (in prep.). The movements and swimming depths of yellowfin tuna in the eastern and central Pacific Ocean.

Scott, M., R. Olson, S. Chivers, and K. Holland. 1995. Tracking of spotted dolphins and yellowfin tuna in the eastern tropical Pacific Ocean. XXIV International Ethological Conference, Honolulu, HI. (Abstract).

Scott, M. 1994. Tracking of Dolphins and Tuna. Annual Report of the IATTC, 1993, La Jolla, CA, pp 48-49.

Scott, M., S. Chivers, R. Olson, and R. Lindsay. 1993. Radiotracking of spotted dolphins associated with tuna in the eastern tropical Pacific. 10th Biennial Conference on the Biology of Marine Mammals. Galveston, TX (Abstract).

Scott, M., S. Chivers, H. Rhinehart, M. Garcia, W. Armstrong, R. Lindsay, D. Bratten, and R. Olson. (in prep.). Patterns of movement and diving by pelagic spotted dolphins in the eastern Pacific Ocean.

Scott, M., R. Olson, S. Chivers, and K. Holland. (in prep.). Simultaneous tracking and patterns of association of yellowfin tuna and spotted dolphins in the eastern Pacific Ocean.

Tuna Oceanography: The second major recommendation of the first Dolphin-Safe Research Planning Workshop was to investigate relationships between physical oceanographic factors and the distribution and abundance of large yellowfin tuna in the ETP. Results of a contract awarded to the IATTC to address this issue indicate that schools of large unassociated yellowfin can be captured in some areas of the ETP and that associated yellowfin appeared to be more closely tied than unassociated yellowfin, to oceanographic characteristics of wind stress and temperature. Study design and results appear in:

P.O. 40ABNF202035. "Contract with IATTC to conduct a study of environmental predictors of yellowfin tuna abundance, catchability, and distribution". Awarded to Dr. Richard Deriso, IATTC. $35,000.

Punsley, R. 1993. Effects of thermal structure on the vulnerability to capture of medium to large yellowfin tuna. IATTC Annual Report, 1993, La Jolla. pp 22-23.

Punsley, R. G. and P. C. Fiedler. (Submitted). Purse-seine catch rates of medium and large yellowfin tuna with and without dolphins in the eastern Pacific Ocean. ICES Journal of Marine Science.

Food Habits: The third major recommendation from the first Dolphin-Safe Research Planning workshop was to investigate dietary characteristics of the apex predator assemblage in the ETP, particularly differences between large yellowfin tuna and dolphins in prey preferences. Significant differences in diet would imply strongly that tunas and dolphins are unassociated at some times. Preliminary results indicate that diet differences do exist. Study design and results appear in:

P.O. 40ABNF202034. Contract with IATTC to conduct food habits study of tuna and dolphins". Awarded to Dr. Robert Olson, IATTC. $133,000.

Contract status as of September 1995: isotope samples have been collected and isotope analyses are in progress, while sample collection and analysis has been completed for stomach content study. Results appear in:

Galvan-Magana, F. and R.J. Olson. 1995. Relaciones troficas de atunes aleta amarilla y delfines en el Oceanos Pacifico oriental. 20° Reunion International para el Estudio de los Mamiferos Marinos, La Paz, Baja California Sur, Mexico.

Olson, R.J. and F. Galvan-Magana. 1995. Trophic relations of yellowfin tuna and dolphins in the eastern tropical Pacific Ocean. 46th Annual Tuna Conference, Lake Arrowhead, CA (Abstract).

Olson, R. 1994. Trophic interactions of tuna, dolphins, and associated predators. IATTC Annual Report, 1993, La Jolla, Ca., pp 31-32.

Olson, R. (in press). Trophic interactions of tuna, dolphins, and associated predators. IATTC Annual Report, 1994, La Jolla, Ca.

Olson, R.J., F. Galvan-Magana, and J. Martinez. (in prep.). Trophic ecology of tunas, dolphins, and sympatric pelagic predators in the eastern Pacific Ocean.

FADs Experiments: The fourth major recommendation from the first Dolphin-Safe Research Planning Workshop was to investigate fish aggregating devices (FADs) as an alternative to capturing large yellowfin tuna without encircling dolphins. FADS projects related to the Dolphin-Safe Program have included:

I. Cooperative project between IATTC and NMFS with additional major funding from Bumble Bee Seafood Company. Drifting FADs experiment designed by Dr. Martin Hall of IATTC; 30 FADs, ten each of three designs, were deployed in ETP. FADs drifted out of fishing area, results were not conclusive.

Hall, M. 1994. Fish-aggregating devices (FADs) project. IATTC Annual Report, 1993, La Jolla, CA. p. 50.

Hall, M. 1993. Fish-aggregating devices (FADs) project. IATTC Annual Report, 1992, La Jolla, CA. p. 57.

II. NMFS FADs Project: A cooperative effort with three U.S. skippers to investigate the use of drifting and anchored FADs. The Dolphin-Safe Research Program provided radio beacons for five drifting FADs and mooring line for additional anchored FADs, and distributed a questionnaire to the international fleet. Results are summarized in:

Armstrong, W. and C. Oliver. 1995. Recent use of fish aggregating devices in the eastern tropical Pacific tuna purse-seine fishery: 1990-1994. Southwest Fisheries Administrative Report. LJ-95-14.

LIDAR Development: In September 1990, NMFS initiated development of an airborne LIDAR system for use aboard tuna vessel helicopters to search for subsurface schools of large yellowfin tuna unassociated with dolphins. LIDAR (light detection and ranging) systems work by sending an intermittent laser beam downward into the ocean and analyzing the return signals generated when the light beam reflects back from the surface and from submerged objects. Tests along the southern California coast were conducted in May and September 1991. Numerous mechanical and technical problems preventing fish spotting were identified and rectified. Successful imaging of bottom contours and fish schools was accomplished during the second set of test flights.

The LIDAR developed and tested locally during 1990-1992 was field tested during commercial fishing operations aboard the helicopter of one of tuna purse-seine fleet owner Ed Gann's purse-seiners, with vessel and helicopter participation provided by Mr. Gann. Trials were conducted during October 1992. Flights were conducted as pre-selected transects across the net in an attempt to calibrate tuna detection with tuna catch. Subsurface tuna were detected within the net at depths to 18 meters.

LIDAR development and results are documented in:

Churnside, J.H,.1995. Data Report: *in situ* data from 1994 LIDAR cruise of R/V David Starr Jordan. NOAA Data Report ERL ET-5.

Ciancinatto, F. 1995. *In situ* test of KAMAN LIDAR system (wide swath). Memorandum received from KAMAN Aerospace Corp.

Grams, G. W. and Clyde Wyman. 1993. Final Report: Extended Field Tests of an Airborne LIDAR During Tuna Purse-seine Fishing Operations in the Eastern Tropical Pacific Ocean". Grams Environmental Labs, Norcross, Georgia. (P.O. 41ABNF201797; $24,500.)

Grams, G. W. 1992. Final Technical Report: Project Osprey-1.(Airborne System for Detecting and Classifying Schools of Tuna) (Proprietary Report). Remote Sensing Industries. (P.O. 52ABNF000126; $45,000). (describes details of LIDAR system).

Grams, G. W. 1992. Final Technical Report: Osprey III(OSPREY-2, OSPREY.C)(Proprietary Report). Remote Sensing Industries, Inc. (P.O. 43ABNF2006922; $24,500). (describes preliminary field testing of LIDAR in Panama, prior to testing at sea during commercial seiner operations).

Oliver, C., W. Armstrong, and J. Young. 1994. "Development of an airborne LIDAR system to detect tunas in the eastern tropical Pacific purse-seine fishery" NOAA-TM-NMFS-SWFSC-204. 65 pp.

Oliver, C. 1994. "Description of the 'LIDAR.C version 1.20' software incorporated into an airborne LIDAR system to detect tunas in the eastern tropical Pacific purse-seine fishery", SWFSC Administrative Report LJ-94-21, and

Oliver, C. 1994. "Description of the 'LIDAR.C version 1.40' software incorporated into an airborne LIDAR system to detect tunas in the eastern tropical Pacific purse-seine fishery." SWFSC Administrative Report LJ-94-16.

Continued testing of narrow-beam LIDAR, in cooperation with the Coastal Division of the Southwest Fisheries Science Center, was conducted during 1995 and is scheduled also for FY96. LIDAR was tested successfully on fish in tanks on shore and again at sea during August-October 1995.

Dolphin-Safe Research Program Data Base: In-house catalog and database documenting receipt of all solicited and unsolicited proposals received concerning dolphin-safe research possibilities.

SBIR Solicitations. Small Business Innovative Research (SBIR) grants are made available annually on a competitive basis from the Department of Commerce (DOC) and other agencies, using a statutory percentage of the research and development budgets. Potential topics are submitted to DOC by interested agencies within the Department. The topics are gathered together and distributed in a program solicitation booklet issued annually. Research contracts can be awarded for start-up projects (Phase 1 contracts, up to $50,000) or expansion projects (Phase II, up to $200,000). The program is quite competitive: in 1993, program directors expected NOAA to be awarded up to twelve Phase I and six Phase II contracts. Solicitations are released in October, reviewed mid-to-late winter, and awarded in the spring.

FY93: Solicitation Topic "Living Marine Resources", Subtopic "Reducing dolphin bycatch in the tuna purse-seine fishery".
Received seven proposals; none funded.

FY94: Solicitation Topic "Living Marine Resources", Subtopic "Reducing dolphin bycatch in the tuna purse-seine fishery".
Received and arranged for review, six proposals; one funded.

Phase I Contract: (proprietary) awarded to ARETE Associates, for development and testing of a Passive Video Tuna Imager: Results promising for detecting large submerged animals. Results summarized in proprietary report:

Davis, P. et al. 1995. SBIR Phase I Final Report (proprietary): Automated Airborne Tuna School Detector. ARETE Associates. Passive daytime multispectral imaging system.

FY95: Solicitation Topic "Living Marine Resources", Subtopic "Reducing dolphin bycatch in the tuna purse-seine fishery".

Phase II proposal from ARETE highly ranked, but funding restrictions eliminated award.

Tuna Bycatch Study: Methods were developed for estimating bycatch from a data set with many zeros and severe rounding at higher values. These methods were then used to estimate tuna bycatch

from the U.S. and the international fleet under observed and hypothetical distributions of effort on log, school and dolphin sets. Estimated average tuna discard from log, school, and dolphin sets was 10, 1 and 0.1 tons/set, respectively. Methods development appears in:

Perkins, P. and E. Edwards. in press. "A mixture model for estimating tuna discards from data with many zero observations; tuna bycatch in the eastern tropical pacific Ocean". Fish. Bull. 94(2):000-000.

Using these methods, average annual discard of tuna was estimated for the international fleet under observed effort conditions, and assuming that all dolphin effort were redirected either to log sets, school sets, or equally to log and school sets. Under observed conditions (60% of sets were made on dolphins, 20% each on school and log sets) tuna discards were minimal and probably negligible. Redirecting all dolphin sets to log sets increased estimated discards to about 30% the weight of landings. This would directly reduce the number of recruits available for future catch, and might effect future stock levels if a stock recruitment relationship exists, although no such relationship has yet been demonstrated.

Edwards, E.F. and P. Perkins. 1995. Bycatch of tuna in log, school, and dolphins sets by the purse-seine fleet in the eastern tropical Pacific Ocean, 1989-1992. in Southwest Fisheries Center review.

PHASE II RESEARCH: Are unassociated large yellowfin detectable?

Decision Theory Investigation: Two contracts were awarded to Dr. Tony Starfield, Professor, University of Minnesota, to investigate methodology for making decisions about research priorities aimed at finding a "dolphin-safe" fishing technique for large yellowfin tuna. Characterization of the tuna-dolphin problem in decision-theoretic terms led to a recommended two-step approach involving feasibility studies to direct data collection, then choosing research projects based on optimal probability of successful outcome. Accomplishing the first step was recommended to occur in a workshop setting. This recommendation led to development of Research Planning Workshop II (see below). Contract results summarized in:

Starfield, A.M. and K. Ralls. 1993. Assessment of Decision Analysis Techniques Applicable to the Dolphin-Safe Research Project. Final Report, Contract P.O. 403JGNF0139 ($9,800).

Research Planning Workshop II: Upon determining an affirmative answer to the Phase I question (Are tunas and dolphins ever unassociated in the ETP?), a second planning workshop was held to determine research protocols for addressing the Phase II question: Can unassociated large yellowfin tuna in the ETP be detected routinely with fishery-practical technology? The workshop was attended by agency scientists from NMFS, IATTC, and PNAAPD (the Mexican tuna-dolphin program), technical experts in modern detection technologies (acoustic, optical, and radar), and industry representatives including skippers, fleet managers, and fleet owners. This facilitated workshop produced strong research recommendations for modeling studies of signal propagation and target strength specific to ETP oceanography and large yellowfin, prior to designing a research survey to determine the extent of potential commercial resource. Results are summarized in:

Edwards, E.F., C.W. Oliver, and J. Sisson. 1995. 2nd Dolphin-Safe Research Planning Workshop: Report and Recommendations. Southwest Fisheries Administrative Report LJ-95-10.

Starfield, A. M. and K. Ralls. 1994. Description and Evaluation of a Workshop Designed to Develop a Hierarchy of Research Projects for the Dolphin-Safe Research Program. Final Report, Contract P.O. NFFR2100300041 ($15,000).

Detection Technology Contracts: The primary recommendation from the second Research Planning Workshop was to determine, using mathematical models, signal propagation in the ETP physical environment and target strength and signatures for large yellowfin tuna for each of the three most promising detection modes: acoustic, optic, and radar. These modeling studies will indicate which, if any, modes will be appropriate for subsurface detection of large unassociated yellowfin tuna in the ETP, what the optimal detection system configuration(s) will be for each mode, and whether it would be feasible to develop commercially available detection systems using the optimal configurations. Preliminary work indicates that some sort of acoustic system will probably be the most effective for long-range detection. Final reports will be available by March 1996. Study designs appear in:

P.O. No. 40ABNF501351(a1; $43,000). Acoustic Propagation Modeling of low frequency sound in the ETP. Awarded to Drs. William Marsh and David Rees, NCCOSC (San Diego), to model 1) the acoustic characteristics of ETP surface waters, 2) a variety of propagation paths and 3) the maximum range of detection for tuna schools using a variety of low frequency sounds.

P.O. No. 40ABNF501351(a2; $6,000). Acoustic target strength modeling of schooled large yellowfin tuna. Awarded to Drs. Richard Love and Woodrow Nero, Office of Naval Research (Stennis Space Center) to model the acoustic target signature of tuna schools using a number of parameter combinations (e.g., school size, orientation).

P.O. No. 40ABNF501351(b; $25,000). Enhancements to Existing Radar: Awarded to Dr. Byron Summers, NCCOSC (San Diego), to investigate potential enhancements to both X-band and S-band radars to detect tuna schools.

Non-ETP Tuna-Dolphin Fishing: Because conflicting claims have been made about the prevalence of directed "dolphin fishing" outside the ETP, the Dolphin-Safe Research Program includes a project to review reports of marine mammal captures in the course of purse-seine fishing for tuna outside the ETP. Little evidence has been found for any significant levels of directed dolphin-fishing outside the ETP. A draft MS has been completed and is in review:

Donahue, M. (in prep.). Incidence of dolphin-fishing outside the eastern tropical Pacific Ocean.

Separation/Attraction Workshop: A workshop was held at the Southwest Fisheries Science Center on September 20, 1995, to evaluate the potential for separating tunas and dolphins prior to capture by purse-seine. The workshop was attended by scientists and tuna skippers long familiar with the tuna-dolphin association. Workshop participants were not encouraging about the practical

nature of most proposed research in this area. The workshop report (in prep) will summarize the practical constraints that must be accounted for in any future proposals for investigation into this area. Workshop results will appear in

Edwards, E.F. (in prep.). Tuna/Dolphin Separation/Attraction Workshop: Report and Recommendations.

Capture Stress Study: A recently completed study in the Dolphin-Safe Research Program suggests that analysis of color darkness in adrenal glands may indicate stress in dolphins captured by purse-seines in the ETP. Results are summarized in:

Myrick, A. C. and P. Perkins. 1995. Adrenocortical color darkness and correlates as indicators of continuous acute premortem stress in chased and purse-seine captured male dolphins. Pathophysiology 2 (1995):191-204.

Other ongoing or proposed dolphin stress projects are summarized in:

Myrick, A.C. 1995. Documentation of progress of stress research projects for future reference. Southwest Fisheries Administrative Report LJ-95-01.

A related study is investigating the potential capture rate (captures/yr) of ETP dolphin schools as a function of school size. Results will appear in:

Edwards, E. F. and P.C. Perkins. (in prep.). Capture rate as a function of school size in spotted dolphins affected by the tuna purse-seine fishery in the eastern tropical Pacific Ocean.

Perkins, P.C., and T. Gerrodette. (in prep.). School size effects on line transect estimates of abundance of spotted dolphins in the eastern tropical Pacific Ocean.

ETP Seabird Research: The Dolphin-Safe Research Program also includes investigations of seabird and seabird community characteristics in the ETP. These ecosystem components are important apex predators in the ETP ecosystem and have potential importance as alternative sighting cues for detecting large yellowfin tuna unassociated with dolphins. Results appear in:

Au, D., R. L. Pitman, and L.T. Ballance. (in press). Yellowfin tuna associations with seabirds and subsurface predators. *In*: Scott, M. (ed). Proceedings of the International Workshop on the Ecology and Fisheries for Tunas Associated with Floating Objects. Special Report of the Inter-American Tropical Tuna Commission.

Ballance, L.T. 1995. Flight energetics of free-ranging Red-Footed Boobies, *Sula sula*. Physiological Zoology 68:887-914.

Ballance, L.T. 1995. Community Structure of tropical Pacific seabirds. Invited Lecture: Oregon Institute of Marine Biology, University of Oregon, Charleston, OR.

Ballance, L.T. 1995. Flight Energetics of free-ranging Wedge-tailed Shearwaters. 1995. Abstract: 22nd Annual Meeting of the Pacific Seabird Group, San Diego, CA.

Ballance, L.T. 1994. Tropical seabird communities of the eastern Pacific. Invited Lecture: Point Loma Nazarene College, San Diego, CA.

Ballance, L.T. 1994. Flight Energetics of Free-ranging Red-footed Boobies. Abstract: 21st Annual Meeting of the Pacific Seabird Group, Sacramento, CA.

Ballance, L.T. 1994. Community structure as determined by flight energetics for tropical Pacific Seabirds. Abstract: 11th Annual Meeting of the American Ornithologists' Union, Missoula, MT.

Ballance, L.T. 1993. Tropical seabird communities of the eastern Pacific. Invited Lecture: Point Loma Nazarene College, San Diego, CA.

Ballance, L.T. (submitted). Flight energetics of free-ranging Wedge-tailed Shearwaters and implications for community ecology of eastern tropical Pacific seabirds. Physiological Zoology.

Ballance, L.T., R.L. Pitman, and S.B. Reilly. (submitted). Geographical ecology of seabird feeding flocks: changes in flock structure along a productivity gradient. Ecology.

Pitman, R.L., L.T. Ballance, S.B. Reilly, and M.P. Force. 1995. Distribution, Movements, and Population Status of Craveri's Murrelet: Implications of Ecology and Conservation. Abstract: 22nd Annual Meeting of the Pacific Seabird Group, San Diego, CA.

Pitman, R.L., L. Spear, and M. P. Force. 1994. Booby prey-capturing behavior in the eastern tropical Pacific Ocean. Abstract: 21st Annual Meeting of the Pacific Seabird Group, 21st Annual Meeting of the Pacific Seabird Group, Sacramento, CA.

Pitman, R.L. and L.T. Ballance. 1993. Booby prey-capturing behavior in the eastern tropical Pacific Ocean. Abstract: 20th Annual Meeting of the Pacific Seabird Group, Seattle, WA.

Pitman, R.L., L.T. Ballance, S.B. Reilly, and M. P. Force. (In Press). Distribution, Movements, and Population Status of Craveri's Murrelet: Implications of Ecology and Conservation. Condor.

Performance Characteristics and Requirements, U.S. Fleet: The Dolphin-Safe Research Program also encompasses NMFS' reviews of U.S. fleet and skipper performance in the ETP, including determination of appropriate data analysis procedures for both U.S. and non-U.S. fisheries. Results of these activities appear in:

Edwards, E.F. 1995. Summary of U.S. Tuna Purse-seine Fleet Characteristics related to Dolphin Mortality in the Eastern Tropical Pacific Ocean. Southwest Fisheries Science Center Administrative Report. LJ-95-04. 13 pp.

Edwards, E.F. 1995. Recommended mortality quota for the U.S. tuna purse-seine fleet, 1995. Memorandum to: Hilda Diaz-Solterro, Director, Southwest Region/NMFS, from Michael Tillman, Director, Southwest Fisheries Science Center, 3/29/95.

DOLPHIN-SAFE RESEARCH PROGRAM PROGRESS REPORTS: FY92-FY95

Dolphin-Safe Research Program, Progress Report I: Review of accomplishments in precursor program and early months of Dolphin-Safe Program. Includes information about the FAD experiment conducted cooperatively by the IATTC and NMFS with major financial support from Bumblebee Seafoods, initial LIDAR contracts, and several very brief tests of separation methods. Intended separation tests included 1) acoustical broadcasts intended to alter the behavior of the tuna and dolphins, 2) chumming with squid to induce feeding behavior by tuna, 3) use of a recently-developed commercial fish attractant, and 4) various combinations of 1-3.

Acoustical deterrent signals intended to frighten dolphins away from the purse-seine net included playbacks of killer whale sounds (records from Iceland, Prince William Sound, Antarctica, British Columbia, and the Gulf of California, Mexico) and false killer whales sounds (ETP only). Sounds of an ETP tuna-dolphin feeding aggregation were collected to test for tuna attraction.

Cruise logistics prevented acoustical experiments prior to net set. All experiments were conducted with both tunas and dolphins already encircled. Acoustic tests were conducted on five sets, chemical stimulants on three sets, and chemical stimulant plus chum (bait) on two sets. Underwater behavioral observations were recorded for 28 sets.

Tuna sounds had no consistent effect on tuna behavior, although sharks seemed attracted. The chemical stimulant and the squid were mostly ignored by the tuna. The feeding aggregation recording elicited no discernable effect on either tunas or dolphins. These results are discussed in:

Young, John and Wes Armstrong. 1992. Progress report of the alternative gear task, Fishery Dependent Assessment Program, 1990-1992. Southwest Fisheries Administrative Report LJ-92-31. 56 pp.

Dolphin-Safe Research Program, Progress Report II: Activities and accomplishments since 1992 are summarized in:

Edwards, E. F. and C. W. Oliver. (in prep.). Dolphin-Safe Research Activities, 1993-1995; Progress Report II.

Dolphin-Safe Research Program; Prognosis for Dolphin-Safe Fishing. The culmination of the first two phases of the Dolphin-Safe Research Program will be a synthesis of all research to date, including results from the contracts currently underway, to produce a prognosis for the potential of dolphin-safe fishing in the ETP and a clear direction for future research. Regardless of future funding, it will be possible with the completion of the projects currently underway to assess the technical probability of developing an effective detection system for locating large, subsurface, unassociated yellowfin tuna in the ETP. Reports will include:

Edwards, E. F. (in prep.). The Future of Dolphin-Safe Fishing in the Eastern Tropical Pacific Ocean.

Edwards, E. F. and C. W. Oliver. (in prep.). Detecting large subsurface yellowfin unassociated with dolphins in the eastern tropical Pacific Ocean: optimal technical design.

Tuna Conference Reports:

Edwards, E.F. 1994. Dolphin-safe Research at the Southwest Fisheries Science Center: accomplishments to date and plans for the future (Abstract). In: Proceedings of the 45th Annual Tuna Conference, Lake Arrowhead, CA, May 23-26, 1994.

Tillman, M. F. 1995. ETP Tuna-dolphin and related activities. In: Director's Report to 46th Annual Tuna Conference: on tuna and related activities at the Southwest Fisheries Science Center, May 1, 1994 - April 30, 1995. Southwest Fisheries Science Center Administrative Report LJ-95-08.

Tillman, M. F. 1994. ETP Tuna-dolphin and related activities. In: Director's Report to 45th Annual Tuna Conference: on tuna and related activities at the Southwest Fisheries Science Center, May 1, 1993 - April 30, 1994. Southwest Fisheries Science Center Administrative Report LJ-94-05.

Tillman, M. F. 1993. ETP Tuna-dolphin and related activities. In: Director's Report to 44th Annual Tuna Conference: on tuna and related activities at the Southwest Fisheries Science Center, May 1, 1992 - April 30, 1993. Southwest Fisheries Science Center Administrative Report LJ-93-05.

Annual Reports to Congress:

Edwards, E.F. 1995. Annual Report to Congress, re NMFS obligations under International Dolphin Conservation Act of 1992. Memorandum to: Dr. N. Foster, Assoc. Admin. NMFS, 1/12/95.

Federal Register. 1993. Notice of Dolphin-Safe Research Program progress and proposed new research, with request for comments. /Vol. 58, No. 103/Tuesday, June 1, 1993/Proposed Rules, p. 31186-31187.

Neal, R. 1993. Annual Report to Congress, re NMFS obligations under International Dolphin Conservation Act of 1992. Memorandum to: Dr. G. Matlock, Acting Southwest Regional Director, 3/15/93.

Tillman, M. 1994. Annual Report to Congress, re NMFS obligations under International Dolphin Conservation Act of 1992. Memorandum to: Dr. G. Matlock, Acting Southwest Regional Director, 1/14/94.

SWFSC Reports:

Southwest Fisheries Science Center Report of Activities. 1994: 1st Quarter. Dolphin-Safe Research Program: Dolphin-Safe FADS Projects reviewed, 1991-1994. pp. 5-6.

Southwest Fisheries Science Center Report of Activities. 1994: 2nd Quarter. Dolphin-Safe Research Program: 2nd Dolphin-Safe Research Planning Workshop held March 14-17, 1994. pp. 6-9.

Southwest Fisheries Science Center Report of Activities. 1993: May-June. Dolphin-Safe Research Program: Study Completed on Allometry of Energetics Parameters in the Spotted Dolphin from the Eastern Tropical Pacific Ocean. pp. 8-9.

Southwest Fisheries Science Center Report of Activities. 1993: May-June. Dolphin-Safe Research Program: effects of dolphin group type, percent coverage, and fleet size on rates of annual dolphin mortality derived from 1987 tuna-vessel observer data. pp. 9-10.

Southwest Fisheries Science Center Report of Activities. 1993: May-June. Dolphin-Safe Research Program: Tuna discards from log, school, and dolphin sets by U.S. Tuna Purse-seiners in the Eastern Tropical Pacific Ocean, 1989-1992. pp. 10-12.

Southwest Fisheries Science Center Report of Activities. 1993: September-October. Dolphin-Safe Research Program: Spotted Dolphins Radio-tracked in the Eastern Tropical Pacific Ocean. pp. 8-9.

Southwest Fisheries Science Center Report of Activities. 1993: November-December. Dolphin-Safe Research Program: 2nd Dolphin-Safe Research Cruise Completed. pg. 10-11.

Southwest Fisheries Science Center Report of Activities. 1992: March-April. Dolphin-Safe Research Program: Dolphin-Safe Strategic Plan Prepared to Develop and Evaluate "Dolphin-Safe" Methods. p 7.

Southwest Fisheries Science Center Report of Activities. 1992: September-October. Dolphin-Safe Research Program: Dolphin-Safe Research Cruise to Begin. pp.7-8.

Southwest Fisheries Science Center Report of Activities. 1992: November-December. Dolphin-Safe Research Program: 1st Dolphin-Safe Tracking Project Completed. pp. 6-7.

PHASE III RESEARCH: Are unassociated large yellowfin commercially abundant? (Proposed)

FY96: Survey Design. It is quite likely that the acoustics modeling contracts will define a practical configuration for an acoustical survey system for detecting large unassociated yellowfin in the ETP. If such is the case, then the final step in the Dolphin-Safe research progression will be to conduct one or more research surveys to evaluate the commercial potential for harvesting such fish. Such a survey will require rigorous and extensive survey design prior to operations at sea.

FY96 will be devoted to this planning, if appropriate. IATTC tuna program personnel will be closely involved in the research surveys, as they are the experts in ETP yellowfin tuna, and are responsible for conservation and management of this stock. The survey design will appear in:

Edwards, E.F., et al. (in prep.). Survey design for determining distribution and abundance of large subsurface yellowfin tuna unassociated with Dolphins in the eastern tropical Pacific Ocean.

FY97: Survey Operations: Assuming successful completion of the research survey design during FY96, then FY97 should be devoted to the actual survey itself. Although it is quite likely that a single survey would not be sufficient, that cannot be determined until survey designs have been completed. Survey results will appear in:

Edwards, E. F. (in prep.). Distribution and abundance of large yellowfin tuna unassociated with dolphins in the eastern tropical Pacific Ocean.

Item 2: Status of yellowfin tuna.

Status of tuna stocks in areas other than the eastern tropical Pacific Ocean (ETP) are not considered here because the focus of the IDCA is the tuna-dolphin fishery in the ETP, specifically. The U.S. does not conduct research on yellowfin tuna in the ETP; that is the charge of IATTC. Thus, information on status of yellowfin in the ETP is available only from IATTC publications.

The Minutes of the 56th (Special) Meeting of the IATTC, held in Panama on October 3, 1995, state that "The total capacity of vessels at sea in 1995 has been slightly greater than in 1994, and markedly greater than in 1993. Water temperatures in the eastern Pacific Ocean have returned to normal after several years of elevated values, and as a result the fishery in 1995 was not dispersed as far away from the equator as in previous years. At last year's meeting some representatives had expressed concern about an apparent decline in catch per unit effort (CPUE), but in 1995 CPUE was higher than in 1993 or 1994." As stated last year, overall the yellowfin stock appears currently to remain healthy and in no danger of overfishing.

Item 7: An assessment of the impact on fishery resources, other than yellowfin tuna, of methods of fishing for large yellowfin tuna in the eastern tropical Pacific Ocean that do not involve the intentional encirclement of dolphins:

This item is addressed currently by the IATTC's comprehensive bycatch program, which samples bycatch from the international tuna purse-seine fleet in the ETP. So few U.S. vessels currently participate in the fishery that U.S. data alone would not be representative of the purse-seine bycatch taken by the entire fleet. As indicated in previous IDCA Annual Reports, the U.S. has analyzed available U.S. data prior to 1992. These results appear in:

Edwards, E. F. and Perkins, P. C. (in prep.). Estimated tuna discard from dolphin, school, and log sets in the eastern tropical Pacific Ocean, 1989-1992.

Perkins, P.C. and E. F. Edwards. 1994. A mixture model for estimating bycatch from data with many zero observations; tuna bycatch in the eastern tropical Pacific Ocean. Southwest Fisheries Science Center Administrative Report LJ-94-07.

Perkins, P.C., and E. F. Edwards. (in press). A mixture model for estimating discarded bycatch from data with many zero observations; tuna discards in the eastern tropical Pacific Ocean. Fishery Bulletin 94(2):0000-0000.

These studies refer only to discards of tuna; the IATTC study, initiated subsequent to the studies listed above, includes discards of all types. Although no formal reports have yet been produced from the IATTC program, the data for tuna discards from that program correspond closely to the data analyzed from the U.S. fleet. A recent peer review of the IATTC program found that the program was well designed in general, although some specific statistical sampling experiments will be helpful for quantifying the results. The peer review report appears in:

Natural Resource Consultants. 1995. A Peer Review of the IATTC Bycatch Data Base. Available from Dr. Robin Allen, Assistant Director, IATTC, Scripps Institute of Oceanography, 8604 La Jolla Shores Drive, CA 92037-1508.